

What is Claimed:

1 1. A method for analyzing an impurity in a gas, comprising
2 the steps of:

3 introducing a first gas containing the impurity into at least a
4 portion of a first cell;

5 introducing a second gas absent the impurity into at least a
6 portion of a second cell;

7 emitting a light from a light source;

8 splitting the light from the light source into a first beam and a
9 second beam;

10 directing the first beam of light through the first cell;

11 directing the second beam of light through the second cell;

12 measuring a decay rate of the first beam of light in the first cell;

13 measuring a decay rate of the second beam of light in the
14 second cell; and

15 determining a concentration of the impurity in the gas based on
16 a difference between the decay rates of the first and second cells.

1 2. The method according to claim 1, further comprising the
2 step of maintaining substantially identical pressures within the first cell and
3 the second cell.

1 3. The method according to claim 1, wherein the first beam
2 of light and the second beam of light have an identical wavelength.

1 4. The method according to claim 1, further comprising the
2 step of tuning the light source to a predetermined frequency.

1 5. The method according to claim 1, further comprising the
2 step of analyzing the first gas and the second gas using cavity ring-down
3 spectroscopy.

1 6. The method according to claim 5, wherein the first cell is
2 filled with the first gas and the second cell is filled with the second gas.

1 7. The method according to claim 5, wherein the first gas
2 flows through the first cell and the second gas flows through the second cell.

1 8. The method according to claim 5, wherein the first cell is
2 filled with the first gas and the second gas flows through the second cell.

1 9. An apparatus for analyzing an impurity in a gas for use
2 with a light source, comprising:

3 a first cell at least partially containing a first gas with the
4 impurity;

5 a second cell at least partially containing a second gas absent
6 the impurity;

7 a splitter optically coupled to the light source to split the light
8 from the light source into a first light beam and a second light beam, the first
9 light beam coupled into an input of the first cell and the second light beam
10 coupled into an input of the second cell;

11 a first detector coupled to an output of the first cell and
12 generating a first signal based on a decay rate of the first light beam within
13 the first cell; and

14 a second detector coupled to an output of the second cell and
15 generating a second signal based on a second decay rate of the second light
16 beam within the second cell,

17 wherein a concentration of the impurity is determined based on
18 a difference between the first decay rate and the second decay rate.

1 10. The apparatus according to claim 9, further comprising a
2 processor coupled to the first detector and the second detector to receive
3 and process the first signal and the second signal to determine the
4 concentration of the impurity.

1 11. The apparatus according to claim 9, wherein the first light
2 beam and the second light beam have an identical wavelength.

1 12. The apparatus according to claim 9, wherein the first
2 detector measures the decay rate of the first light beam in the first cell.

1 13. The apparatus, according to claim 9, wherein the second
2 detector measures the decay rate of the second light beam in the second cell.

1 14. The apparatus according to claim 9, wherein a pressure of
2 the first gas in the first cell and a pressure of the second gas in the second
3 cell are substantially identical.

1 15. The apparatus according to claim 9, wherein the gas
2 comprises ammonia and the impurity comprises water.

1 16. The apparatus according to claim 9, wherein the light
2 emitting source comprises a CW laser.

1 17. The apparatus according to claim 16, wherein the laser is
2 tuneable.

1 18. The apparatus according to claim 9, wherein the first cell
2 and the second cell each comprise a cavity ring-down spectroscopy cell.

1 19. The apparatus according to claim 18, wherein the
2 concentration of the impurity is determined by comparing a ring-down rate at
3 a peak of an absorption line of the impurity of the gas to a baseline ring-
4 down rate absent the impurity.

1 20. The apparatus according to claim 18, wherein the
2 concentration of the baseline ring-down rate is measured at an off-peak
3 profile based on extrapolation to a peak wavelength.

1 21. The apparatus according to claim 18, wherein the
2 concentration of the impurity is determined based on a measurement of a
3 whole peak profile, which contains a strength and a lineshape formation, the
4 concentration of the impurity being determined by fitting the lineshape.

1 22. The apparatus according to claim 18, wherein the first cell
2 is filled with the first gas and the second cell is filled with the second gas.

1 23. The apparatus, according to claim 18, wherein the first
2 gas flows through the first cell and the second gas flows through the second
3 cell.

1 24. The apparatus, according to claim 18, wherein the first
2 cell is filled with the first gas and the second gas flows through the second
3 cell.

1 25. An apparatus for analyzing an impurity in a gas,
2 comprising:

3 means for introducing a first gas containing an impurity into a
4 first cell and a gas absent impurity into a second cell;

5 means for emitting a light into the first cell and the second cell;

6 means for determining respective decay rates of the light in the
7 first cell and the second cell; and

8 means for determining a concentration of the impurity in the gas
9 based on a difference between the respective decay rates in the first cell and
10 the second cell.